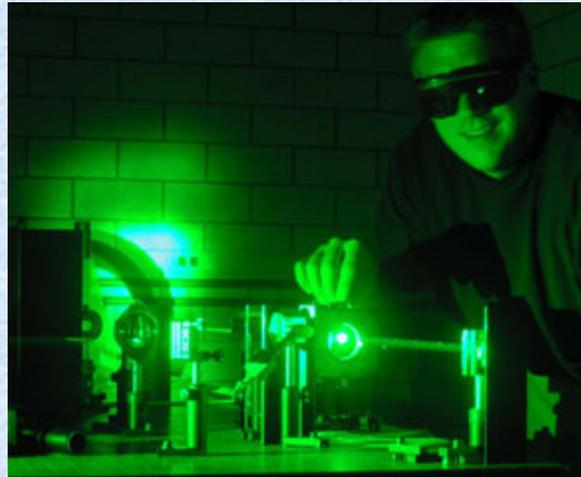


Human Performance Improvement & Laser Safety



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What is HPI?

Human Performance Improvement is a *Proactive, Systems Approach* to prevent adverse events

vs.

- Always looking through the rear-view mirror after an adverse event occurs

vs.

- Avoiding the underlying issues/root causes of events

Human Performance Principles

1. People are *fallible*.
2. Many error- & injury-prone situations are *predictable*.
3. Individual behaviors are *influenced* by the physical and organizational environment.



“We would be eternally miserable if our errors worried us too much because, as we push forward, we will make plenty more.”

E. O. Lawrence, 1934

Views of Human Error

Old

vs.

New

- Human error is a cause of accidents.
- To explain failure, investigators must seek to find failure.
- They must find people's inaccurate assessments and bad judgments.

- Human error is a ***symptom*** of trouble deeper inside a system...
- To explain failure, look for precursors/contributing factors.
- Find how people's actions made sense at the time, given the information and circumstances around them.

Event Precursors/Influences

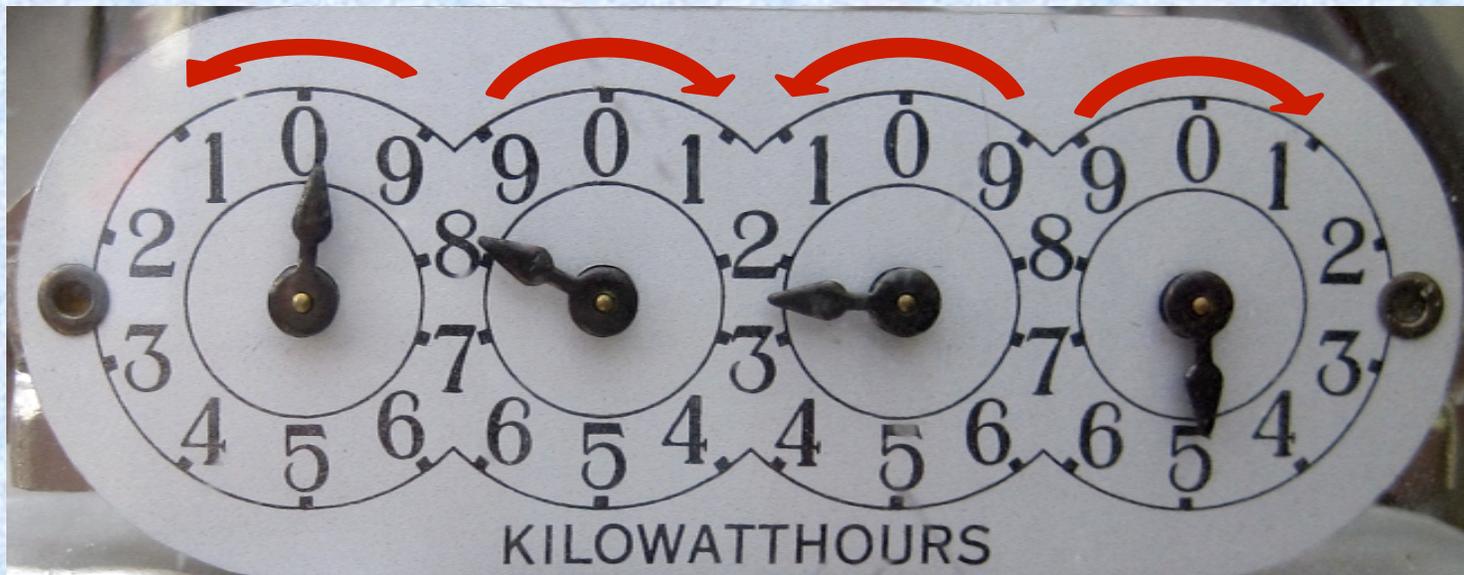
Task Demands	Individual Capabilities
• Time pressure (in a hurry)	• Unfamiliarity with task /technique
• High workload (memory requirements)	• Imprecise communication habits
• Simultaneous, multiple tasks	• Poor problem-solving skills
• Repetitive actions, monotonous	• In denial re: hazards of task (Pollyanna)
• Unclear goals, roles, & responsibilities	• Illness / Fatigue
Work Environment	Human Nature
• Distractions / Interruptions	• Stress (limits attention)
• Changes / Departures from routine	• Limited short-term memory
• Confusing displays or controls	• Assumptions (inaccurate mental picture)
• Unexpected equipment conditions	• Complacency / Overconfidence
• Lack of teamwork	• Mental shortcuts (biases)

Confusing displays, controls, procedures

Complacency / Over-optimism / Wishful thinking

Confusing displays or controls

Classic electric meter design– what's the problem?



Joint Safety Review Process

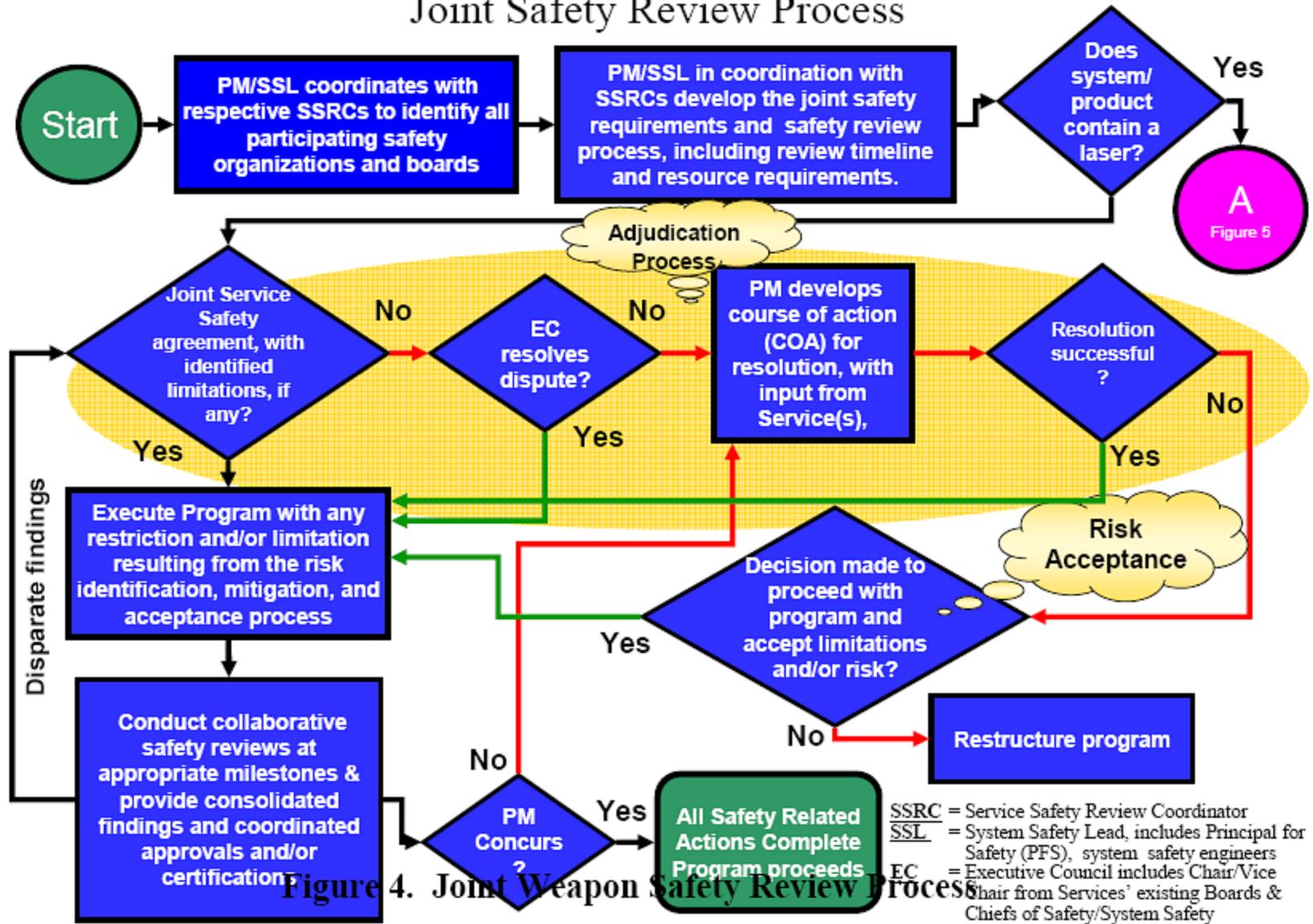
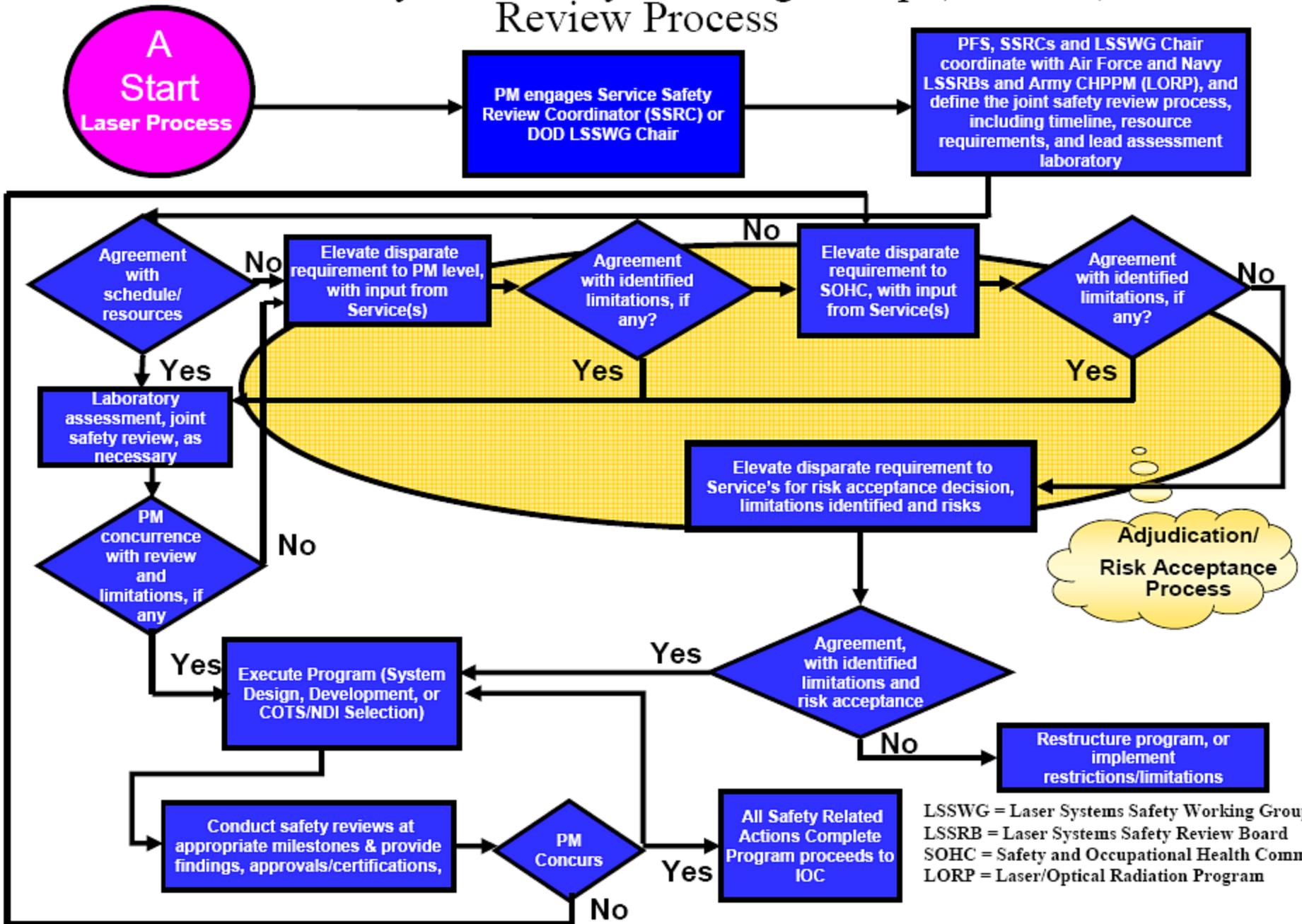


Figure 4. Joint Weapon Safety Review Process

Joint Laser System Safety Working Group (LSSWG) Review Process



LSSWG = Laser Systems Safety Working Group
 LSSRB = Laser Systems Safety Review Board
 SOHC = Safety and Occupational Health Comm.
 LORP = Laser/Optical Radiation Program

Over-optimism

Q: What are you doing?

Q: 'How long would you typically be in that sort of position?'

A: Short time; maybe only 5 min at most

?



HPI ↔ Ergonomics ↔ Human Factors



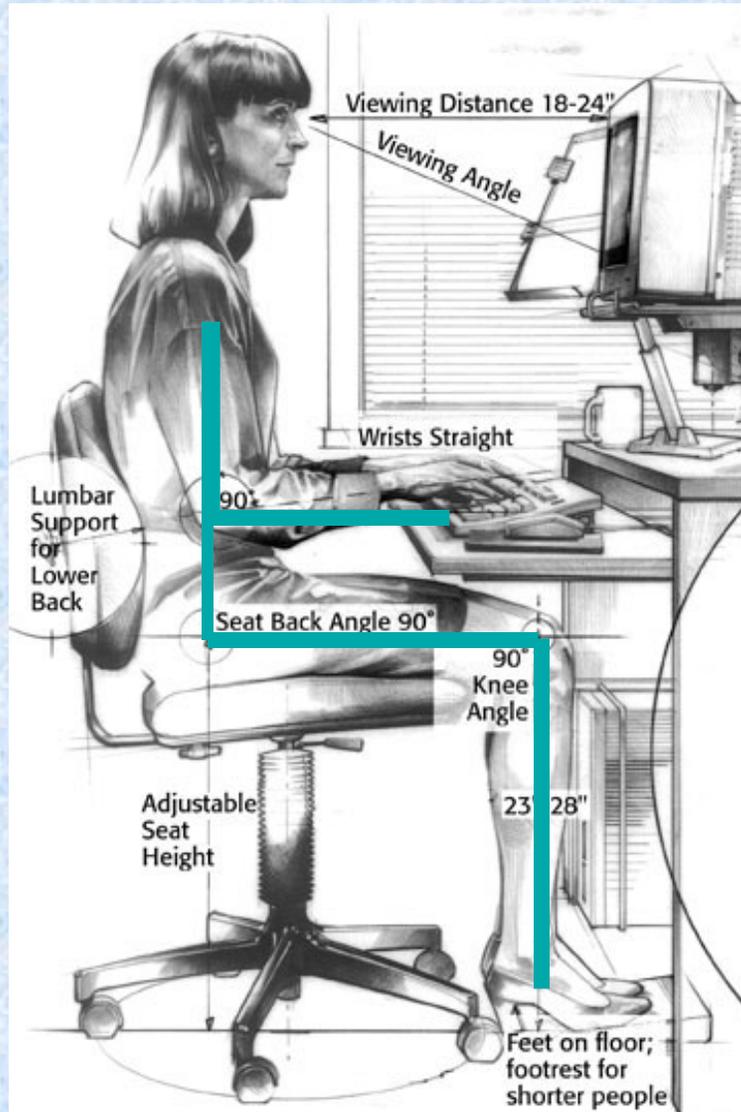
Learn from Success

Learn from Failure

Address: *real* human capabilities and limitations

Observe and ID: how work is *really* done

‘Proper Posture’



- ‘Sit up straight!’
- ‘Keep your elbows, hips and knees at 90°’
- ***It’s ‘Correct’, it’s ‘Proper’, it’s...***

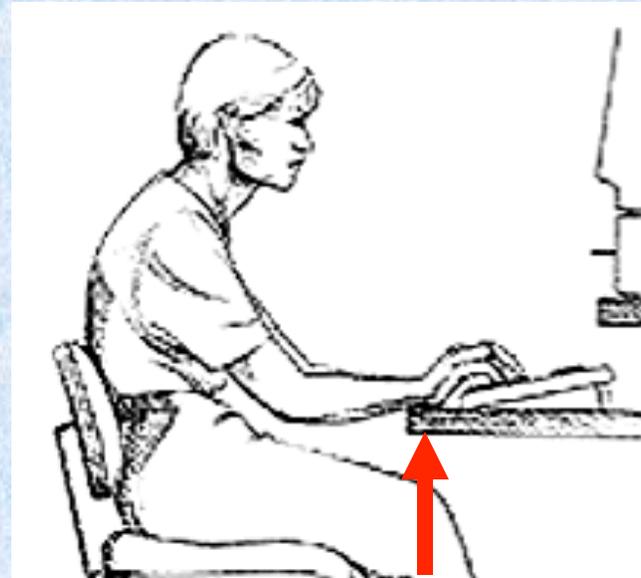
BS !!

Get real...

When we leave their office,
most people unload one way or another



Work as imagined

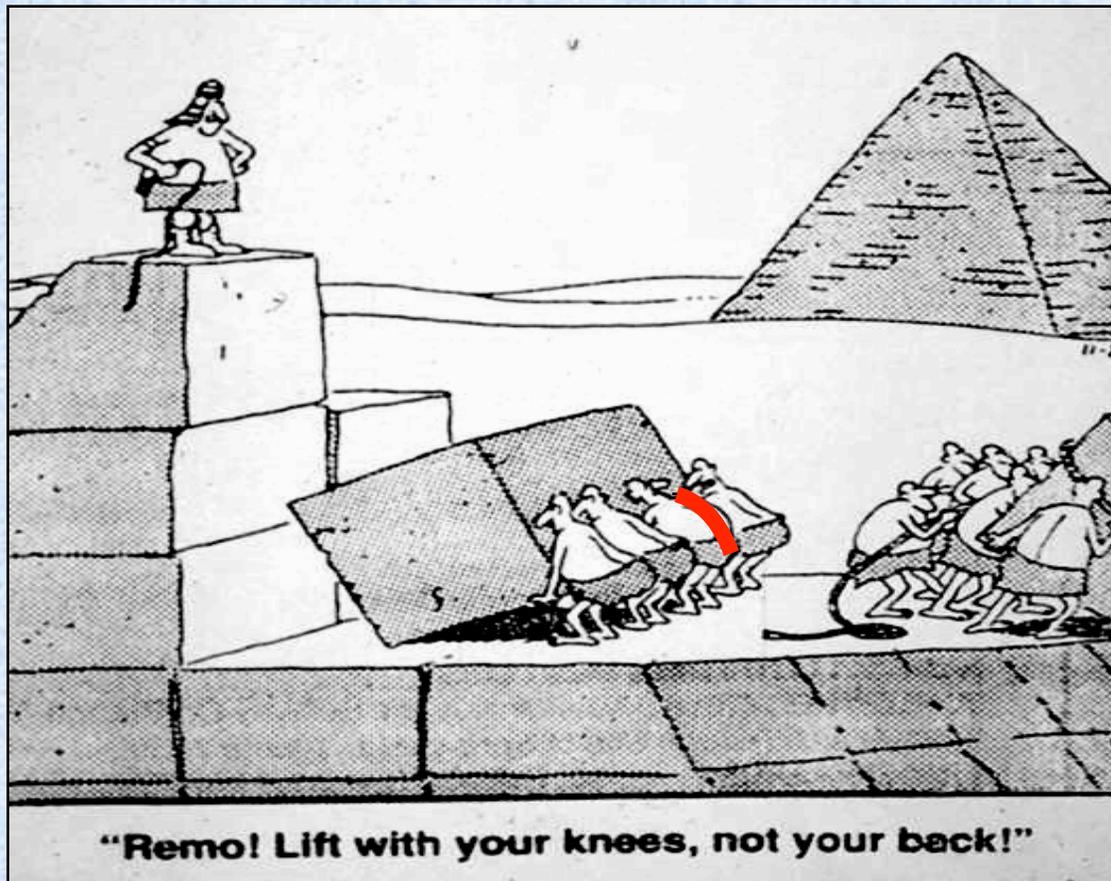


Work as it is really done

We should stop lecturing at people



Training in 'Proper Lifting'



Frank & Lillian Gilbreth

- Pioneers in ergonomics
- Frank and Lillian were parents of twelve children: *Cheaper by the Dozen*



Before the Gilbreths, operating rooms were chaotic, while the patient bled.



“Nurse – scalpel!”

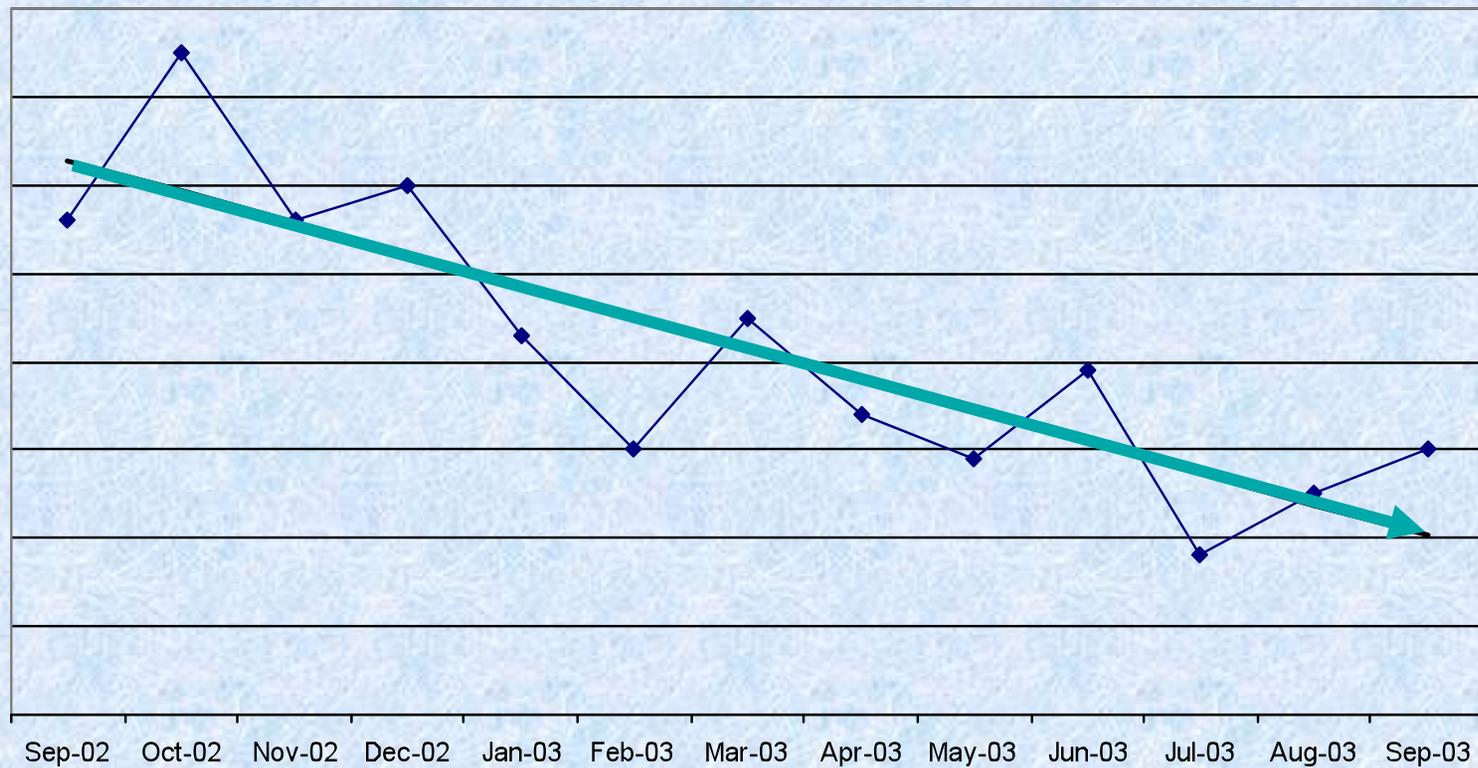
Pharmacy Workflow Redesign





Medication Errors

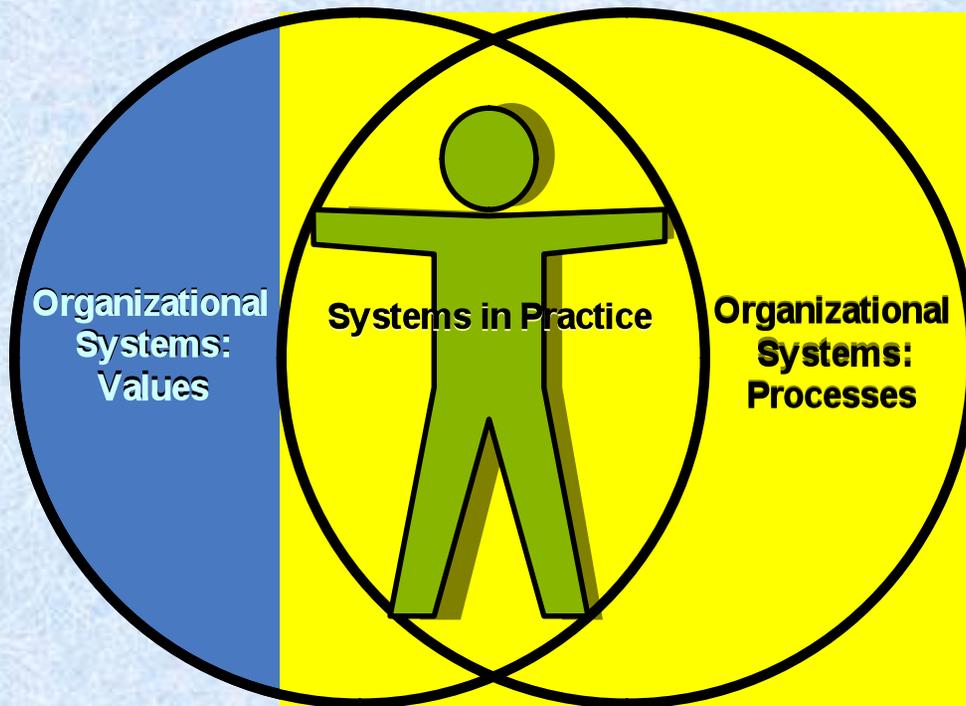
Sept 02 – Sept 03



HPI Objectives

- Management can create an environment where scientists, technicians, et al, can make good decisions by:
 - Recognizing the role of employee state of mind and human fallibility in performance.
 - Identifying how organizational systems can influence human behavior and how we can develop high-reliability organizations to positively influence human behavior.

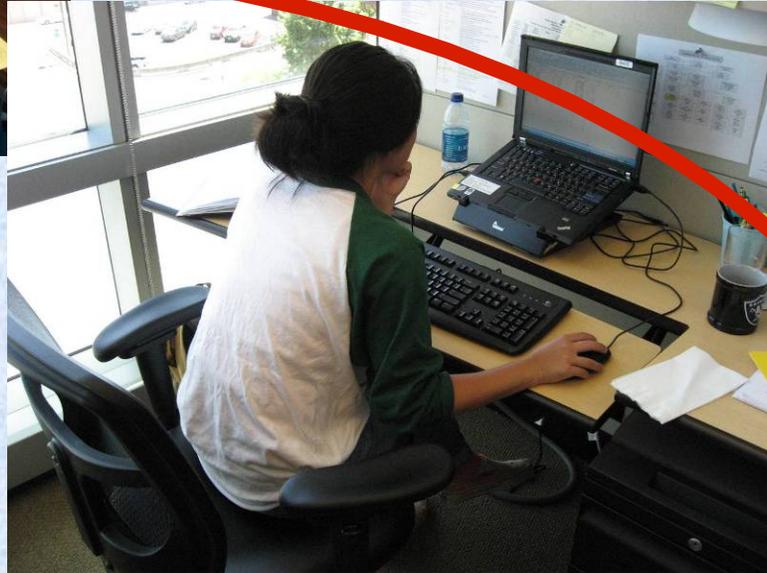
Human ↔ Systems Interface



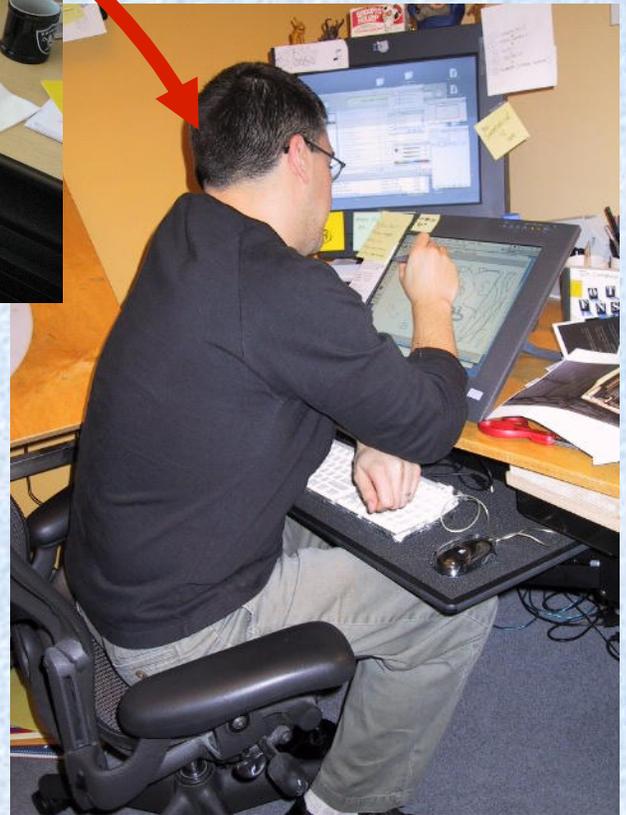
- People will never perform better than what the organization will allow.
- If a system relies on people doing the right thing every time, ***it will fail.***
- No working system remains in stasis.



Desktop



Notebook/Laptop



Tablet





Types of Error

- **Active Errors** change equipment, system or processes that trigger immediate undesired consequences.
- **Latent Errors** result in undetected organization-related weaknesses or equipment flaws that lie dormant.

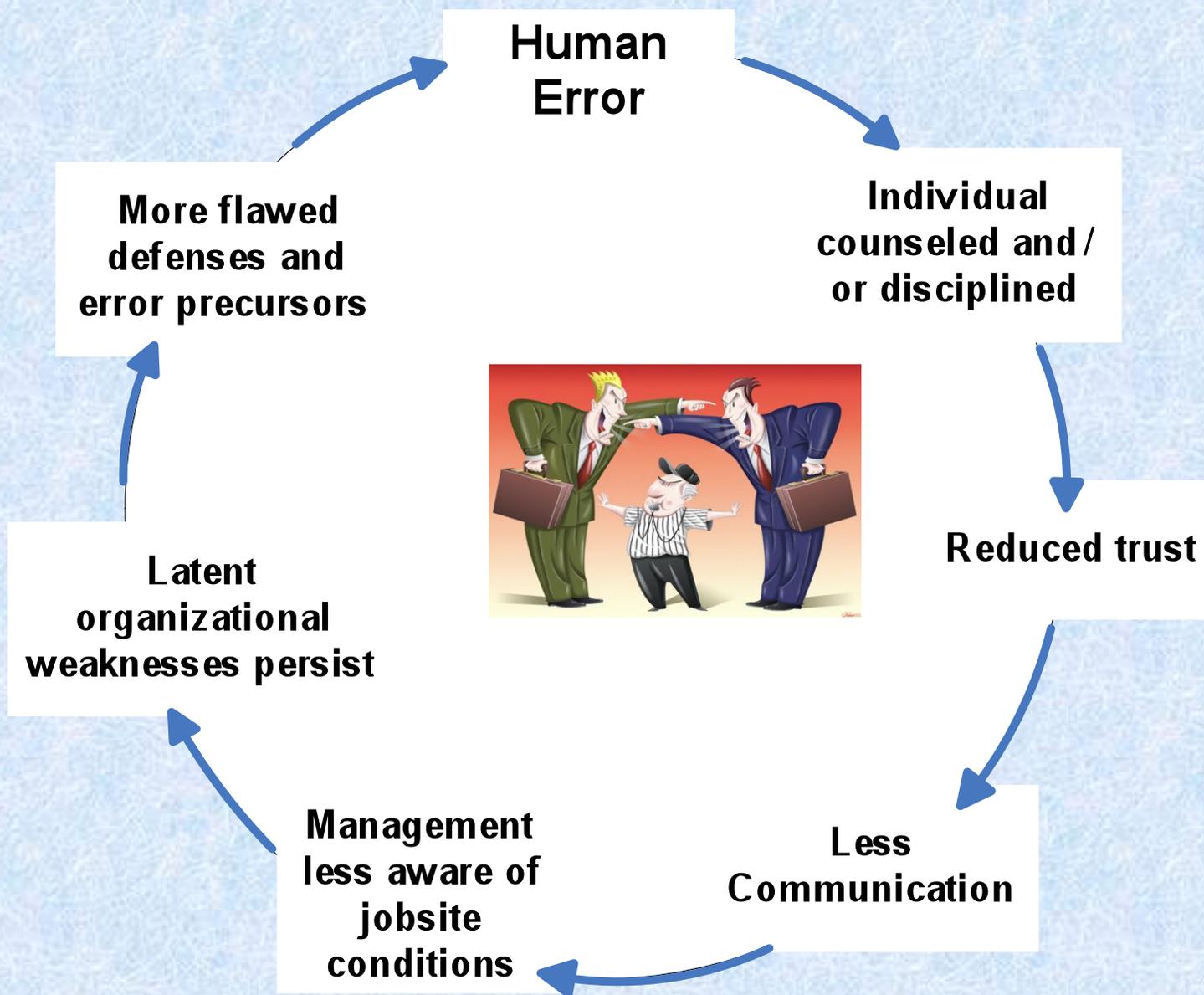
Goal: Create error-tolerant systems

Preventing the next “Accident”



"Figure out what happened to the last crew here, and tell the next crew not to do that."

Blame Cycle





People will show you what they need...







HPI: The New “Standard of Care”

BP Texas City

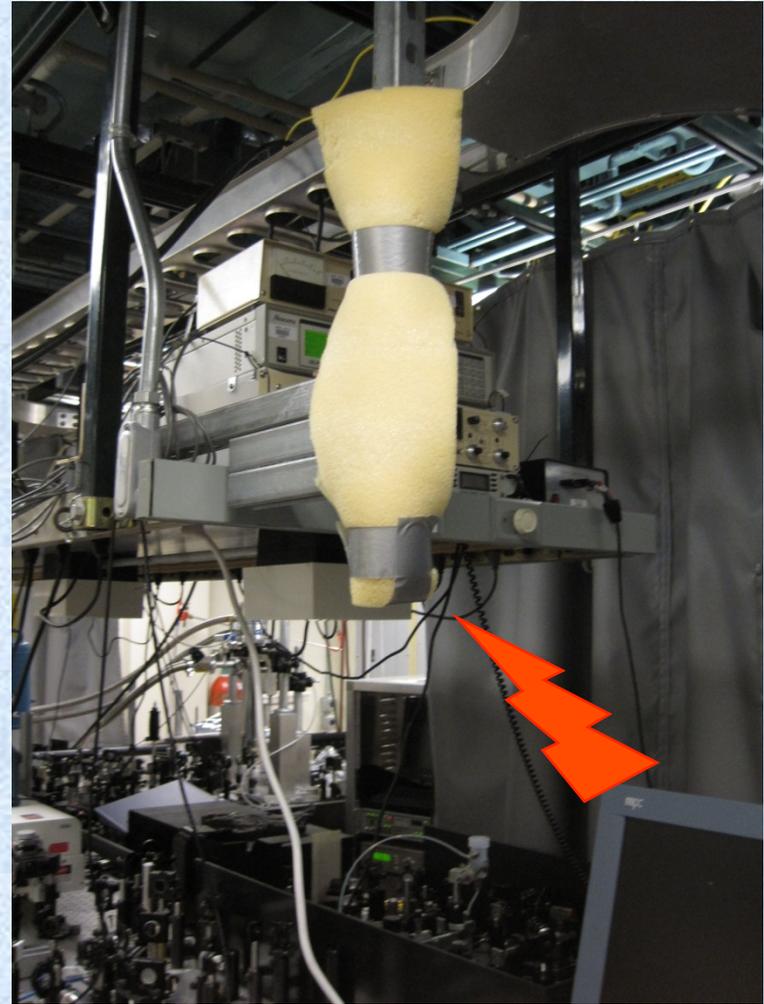
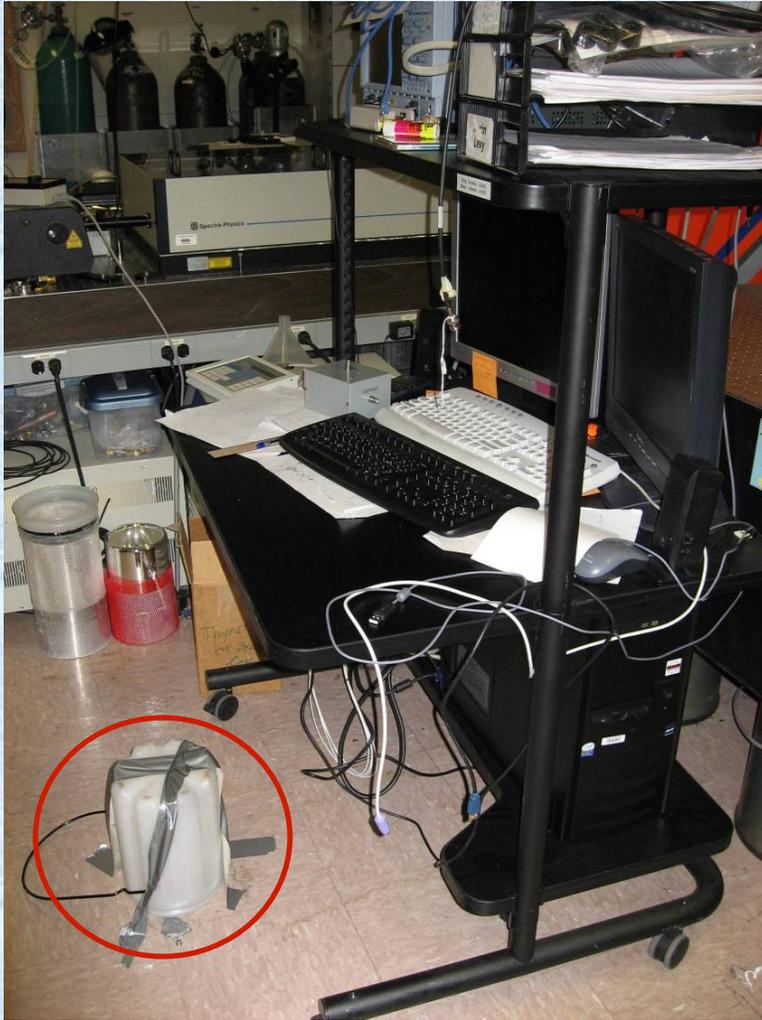
“Although errors and procedural deviations occurred during the startup, it is important to recognize that individuals do not plan to make mistakes. They are doing what makes sense to them at the time, given the work environment, the organization's goals, and other job-related factors.”

US CSB 3-20-2007

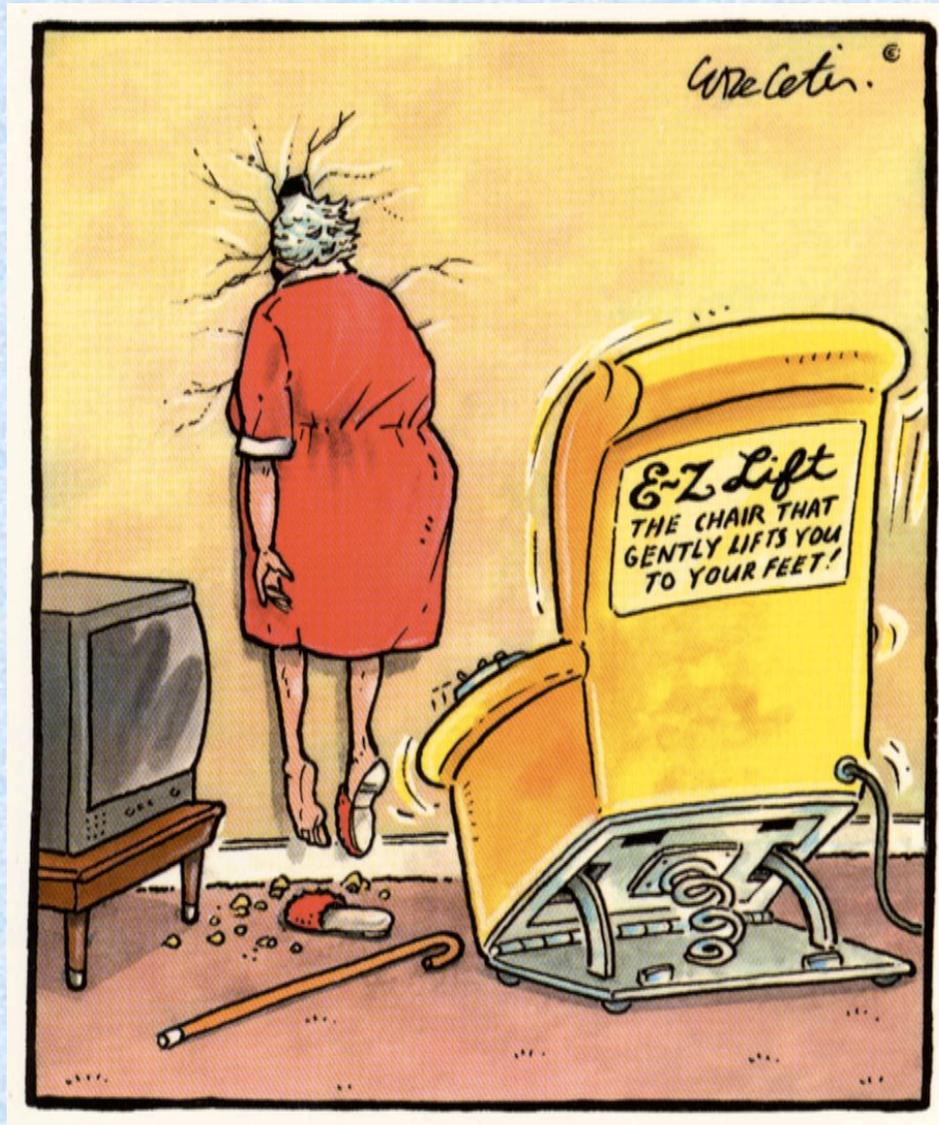
High Performance Culture

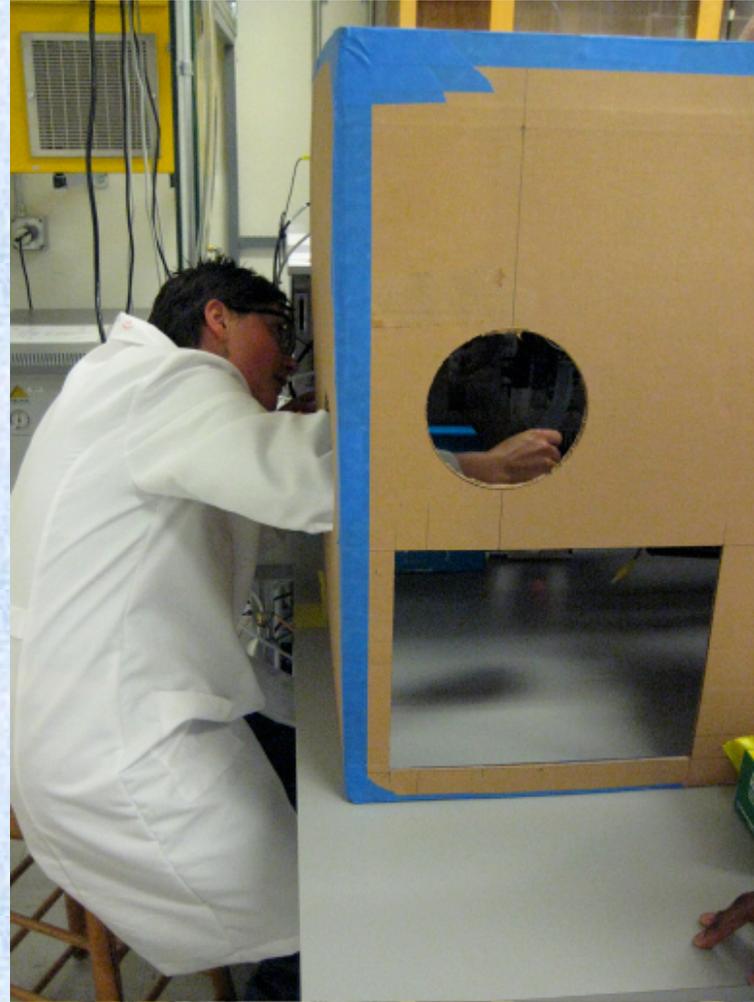
- **Encourage Reporting:** Value errors and near hits as leading indicators.
- **Create a Just Work Environment:** Don't try to punish errors out of the system.
- **Flexibility:** Prepare workers to adapt effectively to changing demands.
- **Learning:** Create opportunities for observation, reflection and feedback.

Retrofits



Test-drive it first!!





- Create mock-ups to simulate proposed designs.
- Collaborate w/ users in analyzing & improving layout.

The first milkshake



There must be a better way to do this!

Thanks!!

“Workplaces and organizations are easier to manage than the minds of individual workers. You cannot change the human condition, but you can change the conditions under which people work.”

— Dr. James Reason